EXHIBIT 1

Expert Report of Julie Chambers

November 18, 2024

Expert Report Related to Illinois River and Tenkiller Ferry Lake, Oklahoma

Prepared by: Julie Chambers, Oklahoma Water Resources Board

November 18th, 2024

Assignment:

I was asked to review findings by the Court regarding Lake Tenkiller, made on the evidentiary record developed in the 2009-10 trial, and to render an expert opinion as to whether they still hold true today. Specifically, I was asked to review the following findings:

1. Lake Tenkiller has become eutrophic, and this eutrophication is caused by phosphorus concentrations in the reservoir.
2. Lake Tenkiller's phosphorus-induced eutrophic condition is manifested in a variety of ways: an increase in amounts of algae, a decrease in water clarity, and a decrease in dissolved oxygen.
3. The decreases in water clarity in Lake Tenkiller are having an adverse impact on recreational activities and aesthetics.
4. Phosphorus concentrations in excess of natural or background levels have caused degradation of water quality in Lake Tenkiller and have impaired its aesthetics, fish and wildlife, and public water supply beneficial uses in violation of Oklahoma's antidegradation standards in Okla. Admin. Code (OAC) § 252:730-3-2(b) and (d).
5. Total phosphorus concentrations have caused impairment of the aesthetic beneficial use for 8,440 acres of Lake Tenkiller that is designated in OAC 252:730 (App. A.1.) of the Oklahoma Water Quality Standards.
6. As a result of phosphorus concentrations, a 5,030-acre section of Lake Tenkiller is not meeting its public water supply beneficial use and is violating water quality standards due to chlorophyll-a levels in excess of the numerical criterion in OAC 252:730-5-10(7) of the Oklahoma Water Quality Standards.
7. Phosphorus has caused injury to Lake Tenkiller, as well as the biota therein.

I was also asked to answer the following questions related to the 2023 Arkansas-Oklahoma Arkansas River Compact Report:

8. What does the 2023 Water Quality Monitoring Report for the Illinois River Basin (Arkansas-Oklahoma Compact) tell us about whether the water in the Oklahoma portion of the Illinois River Watershed is meeting the .037 mg/L water quality standard for phosphorus?
9. What does the 2023 Water Quality Monitoring Report for the Illinois River Basin (Arkansas-Oklahoma Compact) tell us about trends in the phosphorus loading in the Oklahoma portion of the Illinois River Watershed over the past five years?
10. When targeted high-flow water sampling data is included in Oklahoma's Illinois River Watershed water sampling data, what does the data show with respect to phosphorus loading and concentrations in the Oklahoma portion of the Illinois River Watershed?

Experience:

I've been with the Oklahoma Water Resources Board (OWRB) since 1999 and currently serve as the Environmental Programs Manager, leading the Beneficial Use Monitoring Program (BUMP) Lake Monitoring section. I have 25 years of experience in statewide water quality management, from program design through data collection, management, reporting, and dissemination of information. I am responsible for making recommendations for the State's Integrated Report. Over the last 22 years I've successfully led efforts conducting water quality studies, including the National Lake Assessment, and bathymetric surveys on reservoirs across Oklahoma, as well as managing lake and wetland projects funded through federal grants and other contracts.

I am actively engaged in professional organizations, serving on the Board of the Oklahoma Clean Lakes and Watersheds Association and on the Water Quality Steering Committee for the EPA's National Lake Assessment. I also participate in several state technical workgroups focused on the assessment of lakes and field protocol development. As the Oklahoma Environmental Chair for the Oklahoma-Arkansas River Compact Commission, I am responsible for the completion of the annual Water Quality Monitoring Report, specifically addressing phosphorus loading.

For 20 years, I have been an active member of The North American Lake Management Society (NALMS), serving on various committees and in leadership roles, most recently have been re-elected as president after first holding the position in 2016.

I hold a Bachelor of Science in Biology from the University of Central Oklahoma, with a minor in History.

A copy of my resume is attached to this Report.

No compensation has been provided for my testimony, and I have not testified at trial or by deposition in the past 4-years.

Methodology:

For the development of my opinions, I have relied upon my experience with performing assessments for the Integrated Report using assessment protocols outlined in OAC 252:740-15 and the Continuing Planning Process (CPP), completion of the annual Arkansas-Oklahoma Compact Report, and relevant literature.

Assessments for the Integrated Report –

Assessments for the Integrated Report (303(d) list) are completed on a bi-annual cycle and submitted to EPA in even numbered years.

The Oklahoma Department of Environmental Quality (ODEQ) is responsible for submitting the report to EPA and starts the process each cycle by soliciting data and information from various entities, including other state agencies, cities, and tribal nations.

For the lake assessments, including Lake Tenkiller, data are compiled and analyzed to determine attainment of beneficial uses. Data and analytical results are compared to water quality standards

and assessment protocols outlined in the Use Support Assessment Protocol (USAP) in OAC 252:740-15 and the Continuing Planning Process (CPP) document. Following this analysis, recommendations for listing or delisting water bodies are submitted to the ODEQ, which is the agency responsible for completing the State's Integrated Report. Ultimately, the state's Integrated Report is submitted to the U.S. EPA for review and approval. The U.S. EPA has approved the State's 2022 Integrated Report. The State is awaiting approval of its 2024 Integrated Report, which was submitted to the U.S. EPA about a month ago.

Arkansas-Oklahoma Arkansas River Compact Report –

The Oklahoma-Arkansas Arkansas River Compact Commission's Environmental Committee annually creates a report that shows both an annual total phosphorus (TP) loading as well as a 5-year rolling average of TP at four sites—Illinois at Tahlequah, Illinois at Watts (state line), Barren Fork at Eldon, and Flint Creek at Kansas. The 5-year rolling average is compared to a Baseline TP loading (1980-1993) and a 40% reduction goal for each of the sites. The 40% reduction goal comes from the 1996 Diagnostic and Feasibility Study on Tenkiller Lake, which indicated that to reduce/reverse eutrophication in the lake, up to a 40% reduction of influent of total phosphorus from 1992-1993 levels was needed.

To calculate the TP load, 3 types of information are required: Stream flow data, TP concentration, and time. A loading conversion factor (CF) is also applied to all calculations. For the Compact, both Oklahoma and Arkansas use the same calculation to ensure loading for each state's respective stations are calculated identically. The equation is:

2.446848(CF) X Flow (cfs) X TP (mg/L) X 365 (days) = Annual Load

The loadings for the Water Quality Monitoring Report only use data collected by the OWRB and the U.S. Geological Survey (USGS) on ambient monitoring visits—those made on a routine monthly basis—and do not use targeted storm flow data. Because targeted storm flow samples were not available during the Baseline Period (1980-1993), the baseline and 40% reduction target were set using only ambient data. This was agreed to by both states and approved by the Compact Commission. Additionally, the USGS did not start targeted storm-flow sampling until 1999.

Opinion:

The following are my opinions and the reasons for them. The opinions provided in this Report, based on my education, training, knowledge, and experience in the field of water quality management, are held to a reasonable degree of scientific certainty.

1. Lake Tenkiller is currently considered eutrophic based on trophic state classification. Lakes that have high nutrient concentrations and productive plant growth are described as eutrophic. Carlson (1977) developed the most commonly used chlorophyll biomass based trophic status index (TSI) to classify and describe lakes. The Carlson chlorophyll TSI metric has long been used by OWRB to determine lake trophic status and the equation is included below.

   Carlson's TSI calculation based on chlorophyll-a biomass

   TSI = 9.81xln(chlorophyll-a) + 30.6

Lake Trophic State Categories

Trophic State	Carlson TSI Value	Trophic Description
Oligotrophic	≤ 40	Low primary productivity and/or low nutrient levels
Mesotrophic	41-50	Moderate primary productivity with moderate nutrient levels
Eutrophic	51-60	High primary productivity and nutrient rich
Hypereutrophic	≥ 60	Excessive primary productivity and excessive nutrients

The current TSI for the lower portion of Lake Tenkiller (WBID121700020020) is 50 and is 59 for the upper portion (WBID 121700020220). The basis for this listing relied upon the 10 years of data collected by the OWRB and analyzed in the assessment for the 2022 Integrated Report.

2. Lake Tenkiller continues to be listed as not supporting beneficial uses for dissolved oxygen, total phosphorus, and chlorophyll-a on the state's 2022 Integrated Report. [1]

3. Decreases in water clarity in Lake Tenkiller continue to adversely impact recreational activities and aesthetics i.e., scuba diving is a recreational opportunity at the lake and reduced or lower water clarity impacts this activity by reducing visibility. That nutrient loading into the lake has increased algal growth and reduced water clarity is a finding that was included in the 1999 Diagnostic and Feasibility Study on Tenkiller Lake, and is a finding that remains true today based upon OWRB's analysis of water quality data

4. The lake continues to be listed as impaired for the aesthetics (AES), fish and wildlife (FWP), and public water supply (PPWS) on the 2022 Integrated Report. This is in violation of Oklahoma's antidegradation standards in Okla. Admin. Code (OAC) § 252:730-3-2(b) and (d). The basis for this listing relied upon the 10 years of data collected and analyzed by the OWRB, and that analysis was used for assessment for the 2022 Integrated Report.

5. Lake Tenkiller is currently designated as an NLW (nutrient limited watershed), meaning a watershed of a waterbody with a designated beneficial use which is adversely affected by excess nutrients as determined by Carlson's Trophic State Index (using chlorophyll-a) of 62 or greater in OAC 252:730 (App. A.1.) of the Oklahoma Water Quality Standards. Lake Tenkiller also currently has the designation of HQW (high quality water) which carries additional protections outlined in OAC 252:730-5-25.

6. Lake Tenkiller (WBID 121700020220) is not currently meeting its public water supply beneficial use and is violating water quality standards due to chlorophyll-a levels greater than the numerical criterion of 0.010mg/L as outlined in OAC 252:730-5-10(7) of the Oklahoma Water Quality Standards. The basis for this listing relied upon the 10 years of data collected by the OWRB and analyzed that was used for assessment for the 2022 Integrated Report.

7. Lake Tenkiller's water quality has not improved since the 2009-2010 trial as the lake continues to be listed as impaired. This determination is based upon extensive data collected, analyzed by the OWRB, and utilized for the Integrated Report.

---

[1] This is the most current list as the 2024 Integrated Report was submitted earlier this year to the EPA, and we are awaiting EPA approval.

Compact Related Opinions:

8. The 6-month rolling arithmetic means at all stations exceed the 0.037 mg/L total phosphorus criterion for the most recent 5-year time frame 2019–2023, as well as the period of record assessment time frame of 1999-2023.[2] The source of data for these assessments is water quality data collected by both the OWRB and USGS, with flow data provided by the USGS.

9. Based upon OWRB and USGS provided water quality data, trends in phosphorus loadings show that there is an upward tick in the most recent 5-year rolling average time window (2019-2023), and that loadings are generally not meeting the 40% reduction goal, as seen at the Illinois at Tahlequah and Flint Creek, in the 2023 Water Quality Monitoring Report for the Arkansas-Oklahoma Arkansas River Compact. See graphs included in Appendix.

10. When targeted high-flow water sampling data from the USGS is included with the ambient sampling data collected in the Oklahoma portion of the Illinois River Watershed, the data show an increase in both average annual phosphorus concentrations and loadings at all stations in the Oklahoma portion of the Illinois River Watershed. Ambient data is provided by the OWRB and USGS. Targeted high-flow data are provided by the USGS, and these data are regularly above the 0.037mg/L. See graphs and tables included in Appendix.

Julie Chambers Julie Chambers

November 18, 2024

Attachments:

Curriculum Vitae

Reliance Materials:

Carlson, Robert. 1977. A trophic state index for lakes, Limnology and Oceanography. 22(2): 361-369

Jobe, Nobel (1996) Diagnostic and Feasibility Study on Tenkiller Lake, Oklahoma https://www.owrb.ok.gov/studies/reports/reports_pdf/TenkillerPhase1.pdf

---

[2] The change from the 3-month rolling geometric mean to the 6-month rolling arithmetic mean was approved by the Attorney General and became State Rule in 2021.

Oklahoma Department of Environmental Quality (ODEQ) (2012). *Continuing Planning Process* (2012 Version). Available from: https://www.deq.ok.gov/wp-content/uploads/water-division/2012-OK-CPP.pdf

ODEQ (2023). Title 252, Chapter 730, *Oklahoma Water Quality Standards (OWQS)*. Available at: https://www.deq.ok.gov/wp-content/uploads/deqmainresources/730.pdf

ODEQ (2023). Use Support Assessment Protocols (USAP). Title 252, Chapter 740, *Implementation of Oklahoma's Water Quality Standards*. Available at: https://www.deq.ok.gov/wp-content/uploads/deqmainresources/740.pdf

ODEQ (2022). *Water Quality in Oklahoma*, 2022 Integrated Report. Available from: https://www.deq.ok.gov/water-quality-division/watershed-planning/integrated-report/

Wetzel, Robert G. 1983. "Limnology" – Second Edition. 767pp.

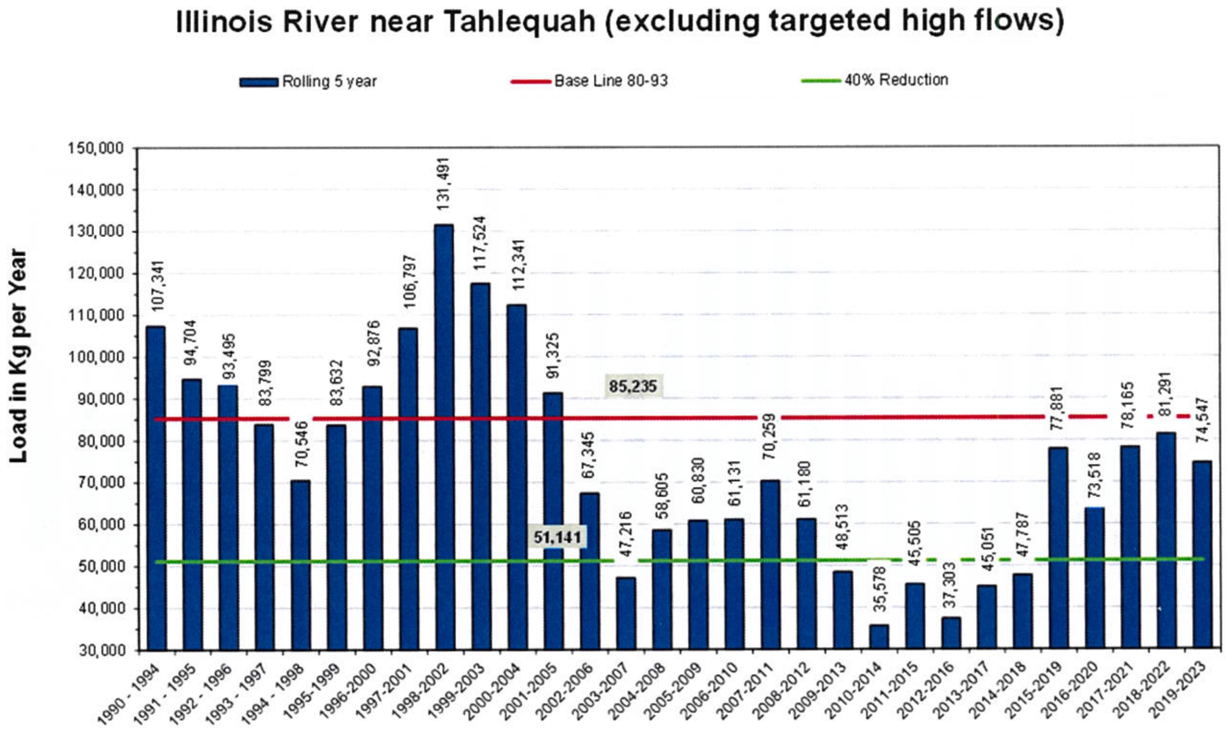
The datasets generated during and/or analyzed during the current study are available in the OWRB Monitoring Databases at https://owrb.gselements.com/DataAnalysisIndex.aspx

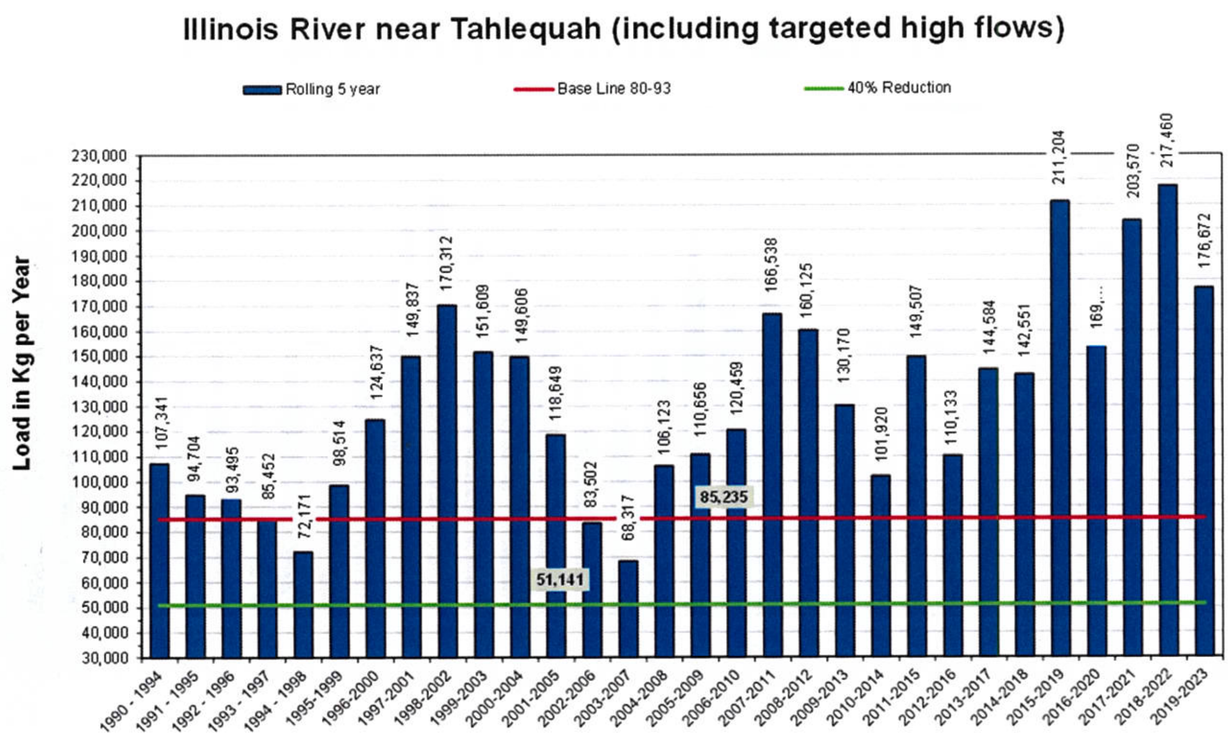
The datasets generated during and/or analyzed during the current study are available in the USGS NWIS Database at https://waterdata.usgs.gov/nwis/qw

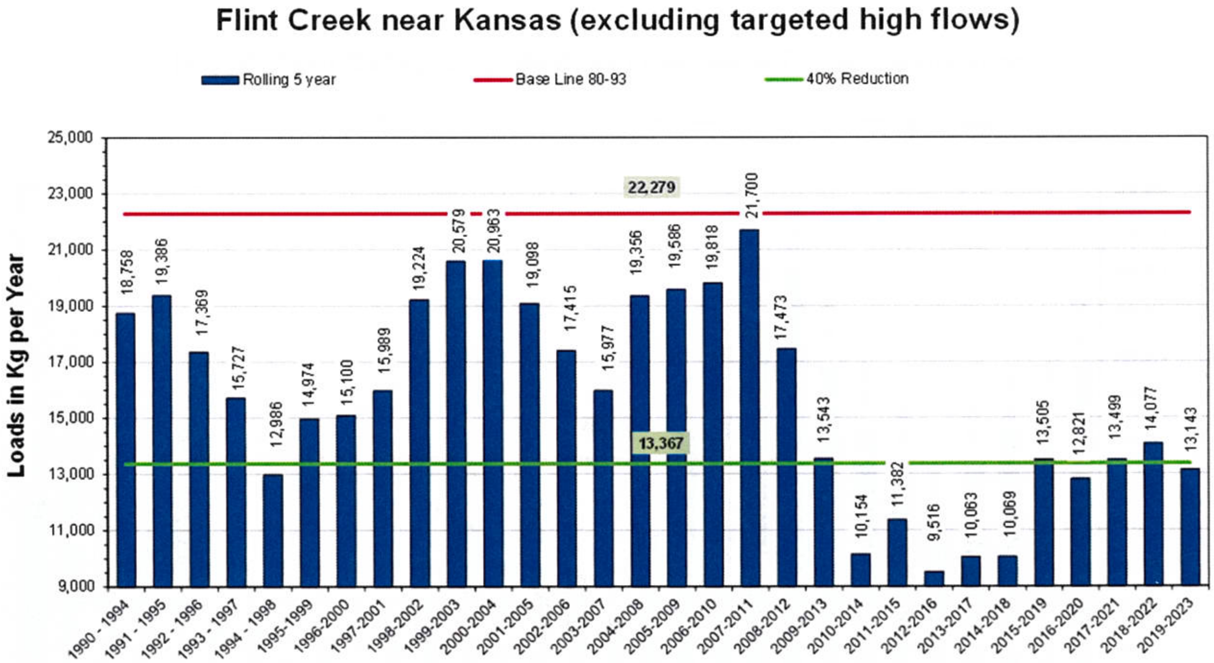
Oklahoma Water Quality Report for the Illinois River Basin for the Arkansas-Oklahoma Arkansas River (CY23) Compact Commission (2024)

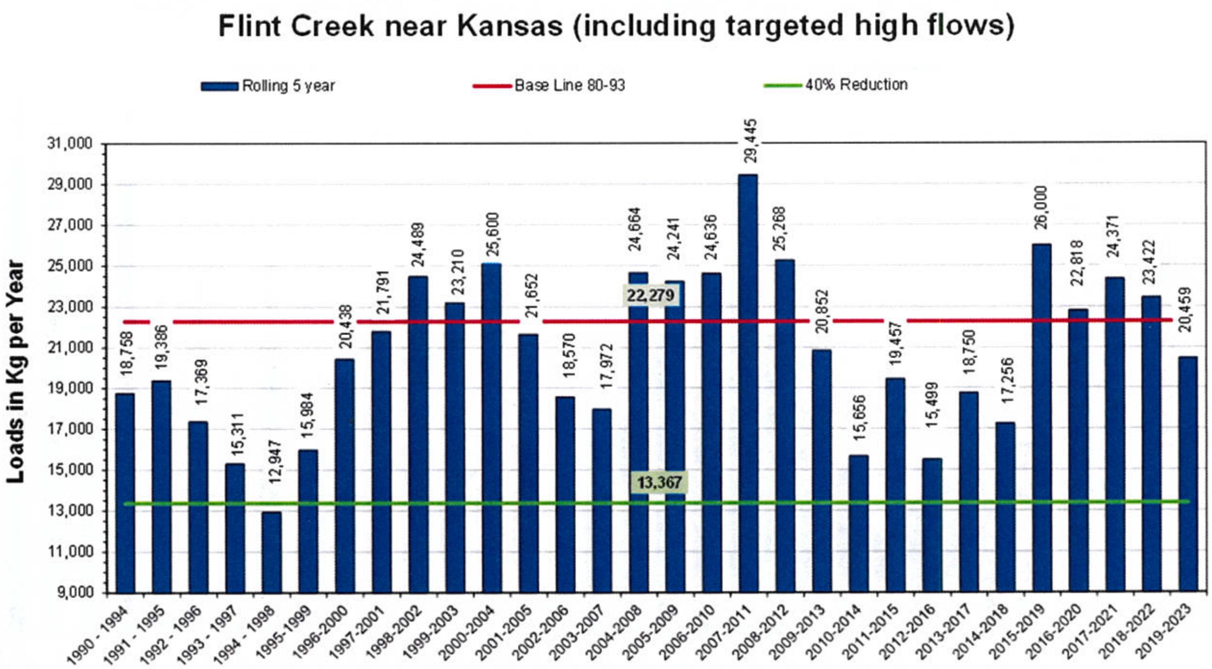
Appendix

5-year Rolling Average graphs extracted from the Oklahoma Water Quality Report for the Illinois River Basin for the Arkansas-Oklahoma Arkansas River. Bottom graphs, include targeted high flow data.






Flint Creek near Kansas (excluding targeted high flows)
Rolling 5 year
Base Line 80-93
40% Reduction
Loads in Kg per Year
22,279
13,367
18,758
19,386
17,369
15,727
12,986
14,974
15,100
15,989
19,224
20,579
20,963
19,098
17,415
15,977
19,356
19,586
19,818
21,700
17,473
13,543
10,154
11,382
9,516
10,063
10,069
13,505
12,821
13,499
14,077
13,143
1990 - 1994
1991 - 1995
1992 - 1996
1993 - 1997
1994 - 1998
1995-1999
1996-2000
1997-2001
1998-2002
1999-2003
2000-2004
2001-2005
2002-2006
2003-2007
2004-2008
2005-2009
2006-2010
2007-2011
2008-2012
2009-2013
2010-2014
2011-2015
2012-2016
2013-2017
2014-2018
2015-2019
2016-2020
2017-2021
2018-2022
2019-2023


Flint Creek near Kansas (including targeted high flows)
Rolling 5 year
Base Line 80-93
40% Reduction
Loads in Kg per Year
22,279
13,367
18,758
19,386
17,369
15,311
12,947
15,984
20,438
21,791
24,489
23,210
25,600
21,652
18,570
17,972
24,664
24,241
24,636
29,445
25,268
20,852
15,656
19,457
15,499
18,750
17,256
26,000
22,818
24,371
23,422
20,459
1990 - 1994
1991 - 1995
1992 - 1996
1993 - 1997
1994 - 1998
1995-1999
1996-2000
1997-2001
1998-2002
1999-2003
2000-2004
2001-2005
2002-2006
2003-2007
2004-2008
2005-2009
2006-2010
2007-2011
2008-2012
2009-2013
2010-2014
2011-2015
2012-2016
2013-2017
2014-2018
2015-2019
2016-2020
2017-2021
2018-2022
2019-2023

Annual Total Phosphorus Load tables, extracted from the Oklahoma Water Quality Report for the Illinois River Basin for the Arkansas-Oklahoma Arkansas River. Red font indicates values with targeted high flow data included.

Illinois River Near Tahlequah						Loadings		
Year	Flow (cfs)	Total P (mg/L)	Total P (mg/L) w/HF	Ortho P (mg/L)		Total P (kg/year)	Total P (kg/year) w/HF	Ortho P kg/year
1980	249							
1981	384							
1982	812							
1983	537							
1984	1,157							
1985	1,651							
1986	1,452							
1987	1,218							
1988	820							
1989	808							
1990	1,695	0.098	0.098	0.078		147,579	147,579	117,307
1991	1,094	0.079	0.079	0.044		76,796	76,796	43,285
1992	1,207	0.080	0.080	0.058		86,205	86,205	62,858
1993	1,751	0.099	0.099	0.086		154,647	154,647	133,796
1994	1,071	0.084	0.084	0.068		80,223	80,223	64,768
1995	1,123	0.080	0.080	0.071		80,229	80,229	71,454
1996	938	0.085	0.085	0.092		71,207	71,207	76,792
1997	812	0.069	0.069	0.066		49,797	49,797	47,621
1998	1,044	0.081	0.081	0.075		75,524	75,524	69,930
1999	1,143	0.121	0.165	0.093		123,518	168,434	94,936
2000	1,083	0.136	0.204	0.111		131,543	197,314	107,362
2001	1,033	0.158	0.229	0.123		145,766	211,269	113,476
2002	851	0.211	0.218	0.151		160,366	165,686	114,764
2003	478	0.100	0.127	0.109		42,690	54,216	46,532
2004	1,157	0.075	0.148			77,499	152,931	
2005	712	0.060	0.080			38,148	50,864	
2006	426	0.074	0.092			28,154	35,002	
2007	736	0.066	0.096			43,383	63,103	
2008	1,839	0.062	0.198			101,829	325,197	
2009	1,407	0.072	0.143			90,475	179,693	
2010	819.8	0.050	0.121			36,608	88,592	
2011	1,540.8	0.058	0.180			79,813	247,696	
2012	491.8	0.038	0.058			16,689	25,473	
2013	946.1	0.043	0.169			36,331	142,791	
2014	659.4	0.038	0.083			22,378	48,878	
2015	2,174.6	0.041	0.187			79,628	363,182	
2016	700.6	0.050	0.052			31,286	32,538	
2017	1,219.7	0.050	0.161			54,465	175,377	
2018	987.2	0.054	0.165			47,610	145,474	
2019	2,308.0	0.100	0.189			206,129	389,584	
2020	1,670.3	0.047	0.095			70,112	141,715	
2021	1,362.4	0.030	0.145			36,502	176,426	
2022	1,577.6	0.040	0.181			56,359	255,024	
2023	1,189.1	0.034	0.044			36,106	46,725	
Average	1,099	0.075	0.126	0.087		73,914	123,605	85,774

Flint Creek Near Kansas						Loadings		
Year	Flow (cfs)	Total P (mg/L)	Total P (mg/L) w/HF	Ortho P (mg/L)		Total P (kg/year)	Total P (kg/year) w/HF	Ortho P kg/year
1980	32	0.189	0.189			5,454	5,454	
1981	57	0.178	0.178			9,077	9,077	
1982	69	0.186	0.186			11,537	11,537	
1983	49	0.284	0.284			12,415	12,415	
1984	143	0.240	0.240			30,532	30,532	
1985	237	0.224	0.224			47,591	47,591	
1986	183	0.223	0.223			36,430	36,430	
1987	141	0.157	0.157			19,840	19,840	
1988	97	0.265	0.265			22,946	22,946	
1989	90	0.557	0.557			44,981	44,981	
1990		0.114	0.114			0	0	
1991		0.120	0.120	0.100		0	0	
1992		0.118	0.118	0.113		0	0	
1993	182	0.156	0.156	0.134		25,359	25,359	21,869
1994	136	0.127	0.127	0.116		15,418	15,418	14,032
1995	140	0.185	0.185	0.130		23,207	23,207	16,308
1996	76	0.152	0.152	0.147		10,294	10,294	9,955
1997	95.7	0.117	0.117	0.115		9,964	9,964	9,829
1998	96.5	0.127	0.127	0.122		10,945	10,945	10,514
1999	137	0.186	0.211	0.151		22,758	25,817	18,476
2000	132	0.178	0.334	0.182		20,984	39,375	21,456
2001	101	0.164	0.211	0.129		14,793	19,033	11,636
2002	82	0.310	0.317	0.180		22,675	23,187	13,166
2003	49.8	0.316	0.294	0.189		14,055	13,076	8,406
2004	149.0	0.165	0.244			21,957	32,470	
2005	91.8	0.168	0.210			13,774	17,217	
2006	36.8	0.226	0.245			7,428	8,052	
2007	70.3	0.240	0.250			15,068	15,696	
2008	218.0	0.157	0.255			30,567	49,647	
2009	141.6	0.187	0.247			23,649	31,236	
2010	91.7	0.171	0.225			14,004	18,427	
2011	137.8	0.152	0.275			18,707	33,844	
2012	48.1	0.107	0.120			4,598	5,157	
2013	121.2	0.093	0.235			10,070	25,446	
2014	72.4	0.096	0.104			6,206	6,723	
2015	253.8	0.070	0.151			15,864	34,222	
2016	82.7	0.092	0.108			6,796	7,978	
2017	130.1	0.085	0.196			9,877	22,775	
2018	115.2	0.097	0.193			9,978	19,853	
2019	289.9	0.090	0.198			23,299	51,257	
2021	190.7	0.082	0.098			13,962	16,686	
2021	143.3	0.074	0.089			9,468	11,387	
2022	191.1	0.068	0.101			11,603	17,233	
2023	131.8	0.066	0.110			7,769	12,948	
Average	123	0.167	0.199	0.139		18,342	21,784	15,251

J U L I E C H A M B E R S

P R O F I L E

Highly motivated self-starter with over 20 years of experience in water quality management, data collection and data utilization.

Participated on and led multiple projects, whose success has been attributed to excellent project management, communications, and planning skills.

Dedicated leader and experienced supervisor

P R O F E S S I O N A L E X P E R I E N C E

ENVIRONMENTAL PROGRAMS MANAGER

OKLAHOMA WATER REOURCES BOARD I 1999-PRESENT

- Manage the Lake and Wetlands Monitoring section of the Water Quality Programs Division
    - 35-40 lakes sampled statewide on an annual basis
    - Wetland projects: identifying potential reference systems - statewide scale; current project is investigating biogeochemistry of oxbow & riverine wetland systems in a localized area.
- Manage program development and operational logistics for lentic systems, including network design, data management, analysis and report writing.
- Conducts program/project budgeting for BUMP and grants, million-dollar budget
- Ensures lake/wetland data collection activities related to federal grants, intra-agency and contracts occur in an efficient and timely manner.
- Collaborate with technical staff to implement project ideas and plans.
- Develop/maintain SOP's related to lake and wetland data collection activities
- Manage a staff of 7 as well as seasonal employees; directing and reviewing work to ensure success.
- Oversee and participate in all aspects of field work
- Make presentations to the Board, represent agency at Water Day at the Capital and other events.

7177 Orchard Trail
Edmond, OK 73025

405.250.0897

julie_chambers@att.net

E D U C A T I O N

B.S, BIOLOGY MAJOR / HISTORY MINOR
University of Central Oklahoma
1995

K E Y S K I L L S

Project Planning & Management
Customer Relations
Budgeting
Skillful Communications
Detail Oriented
Organizational Effectiveness
Writing / Editing
Leadership / Guidance
Water Quality Program Development & Implementation
Strong Interpersonal Skills
Team Player
Dependable
Willingness to take on responsibilities

JULIE CHAMBERS

PROFESSIONAL EXPERIENCE

LEADERSHIP

- President-elect of the North American Lake Management Society
- Past President of the North American Lake Management Society
- Represent the agency as co-chair for the Environmental Committee of the Arkansas-Oklahoma Compact
- Represent the agency on the board of the Oklahoma Clean Lakes and Watersheds Association
- Represent the agency on the Water Quality steering committee for the EPA's National Lake Assessment
- Trainer for USEPA Region 6, for 2012 National Lakes Assessment
- Participate on Oklahoma Water Reuse Workgroup- Water Quality Standards Subcommittee
- Participate on Grand Lake Technical Workgroup
- Serve on various statewide and interstate committees related to nutrient criteria, water quality standards development, TMDLs and implementation
- Serve on the OWRB's SCC Committee, Picnic Committee and Employee Recognition Committee
- Serve as the OWRB's agency safety officer

COMPUTER SKILLS

MS Office Suite
Grapher
Surpher
Corel Draw
DropBox
Social Media Platforms

WEB LINKS

LinkedIn
Linkedin.com/in/Julie-Chambers-b1212949.